DESIGN TIPS FOR RECYCLING PAPER AND CARD PACKAGING
INTRODUCTION

Most paper sent for recycling is used in manufacturing processes as an alternative to virgin material such as wood pulp. This means the quality of the recycled paper has to be as good as any virgin material and economically viable.

The recycling process becomes more difficult when the normal function of paper and card is changed – for example, they are made water resistant or act as a gas barrier. This creates challenges for recycling, such as increasing the costs of reprocessing and waste disposal, reducing the quality of the finished product, and even damaging machinery.

Designers need to explore and develop new materials and techniques for producing paper and card packaging that not only does the job required but is also easier to recycle.

The design tips that follow will help brands and retailers specify and design paper and board packaging that can be reprocessed in mills that use standard pulping technology. They help designers and manufacturers to improve the recyclability of more challenging material in order to increase the quantity and quality of recycled paper.

All the tips reflect the requirements of UK reprocessors and are compliant with the European quality standard EN643.1

This document summarises industry guidelines developed by the Confederation of Paper Industries in partnership with WRAP. The full document can be found at:

www.paper.org.uk/information/publications/

1 https://shop.bsigroup.com/ProductDetail/?pid=0000000000030265770
This guide aims to present considerations for recycling by illustrating some of the common issues, as reported by the recycling industry. To understand some of the issues, it is helpful to understand all aspects of the paper and board recycling process.

On arriving at a mill, paper is fed into large pulpers where it is mixed with warm water (typically 35 degrees Celsius) and agitated to release individual fibres into suspension. Contaminants such as staples, plastic liners, coatings, tape, adhesives, sand and grit are separated and sent for disposal.

Once the remaining fibre is in a solution of 99% water, it is ready for making paper. It is sprayed on to a fast-moving gauze forming a continuous sheet, which allows most of the water to pass through. The sheet then moves through a press section where felt sponges extract more water, and on to a series of steam-heated rollers that dry it further so that the finished sheet contains only about 8% water. Finally, the paper sheet is rolled and cut into reels.

A typical modern paper machine runs at 1000 metres per minute and uses a lot of energy, water and other expensive resources. Any raw material that is contaminated, inefficient or difficult to process reduces the overall viability of high-volume manufacturing, undermining the benefits of recycling paper instead of using virgin materials.
## DESIGN CONSIDERATIONS

<table>
<thead>
<tr>
<th>FILMS AND LAMINATES</th>
<th>NO ISSUES TO RECYLE</th>
<th>MODERATE BUT TOLERABLE ISSUES</th>
<th>PROBLEMATIC. TO BE AVOIDED.</th>
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<tbody>
<tr>
<td></td>
<td>Full compatibility – materials can pass through with no negative effects on the waste streams from the recycling plant</td>
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<td>Low compatibility – negative effects on the waste streams from the recycling plant</td>
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<tr>
<td>FILMS</td>
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<td>Less than 5% by weight</td>
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<tr>
<td>LAMINATES</td>
<td>Removable, peelable by the customer preferred</td>
<td></td>
<td>Two-sided lamination*, oxodegradable materials, PVC</td>
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<tr>
<td></td>
<td>Material density less than 0.95 or greater than 1.15</td>
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<td></td>
<td>Soluble barrier systems</td>
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### TRANSLUCENT PAPERS

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<tr>
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### COATINGS AND ADDITIVES

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<tr>
<td>COATINGS AND ADDITIVES</td>
<td>Water-soluble</td>
<td>Hard sized</td>
<td>UV inks and varnishes</td>
</tr>
<tr>
<td></td>
<td>Metallic inks (as long as not UV cured)</td>
<td></td>
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<tr>
<td>ADHESIVES</td>
<td>Glassine without silicone</td>
<td></td>
<td>Greaseproof, wax/wax coated, silicone</td>
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<td></td>
<td>Under 30% of external surface area</td>
<td></td>
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<tr>
<td></td>
<td>Adhesives with repulp certification</td>
<td></td>
<td>Those which plasticise above 35 degrees C</td>
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<tr>
<td></td>
<td>With repulp certification</td>
<td></td>
<td>Incompatible with paper making</td>
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<td></td>
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<td>Foiled or plastic based</td>
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<td></td>
<td>Glitter</td>
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<td></td>
<td></td>
<td></td>
<td>Baked on food</td>
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<tr>
<td>ALTERNATIVE FIBRES</td>
<td></td>
<td></td>
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<tr>
<td>WRAPPING PAPER</td>
<td>Paper only</td>
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<td>No food</td>
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* food and drink cartons are recycled when sorted and reprocessed separately
TOP DESIGN ISSUES TO CONSIDER WITH REGARD TO RECYCLABILITY OF PAPER AND BOARD PACKAGING

PLASTICS

COATINGS AND BARRIERS

UV INKS AND VARNISHES

TYPES OF FIBRE PACKAGING

TRANSLUCENT AND WATER RESISTANT PAPER

FOOD CONTAMINATION

ADHESIVES

METALLIC/FOIL BLOCK PRINTING

GIFT WRAP
PLASTICS

WHY CAN THIS BE A PROBLEM?
Most paper mills prefer not to receive any plastic laminated board. Some can recycle one-sided laminates but they cannot recycle two-sided laminates.

Plastic is a contaminant and has to be sifted out, which puts pressure on the process, can spoil the final product and reduce the economic viability of recycling.

Plastic with the same density as fibre can also create problems. For example, material with a density between 0.95 and 1.15g/cm³ is also similar to water and so impossible to separate in paper mills.

WHAT ARE THE CONSIDERATIONS?

Keep the plastic content below 5% of the pack weight (3% if possible). Minimise the adhesive between the laminate face and fibreboard so that they are easily separated by the consumer or during the pulping process – this will help prevent the laminate from passing into the reprocessing system.

The industry has no preference for biodegradable or conventional plastics since most plastic waste extracted during processing is sent to energy recovery or landfill. Avoid PVC as it can release toxins during energy recovery. Avoid plastics that readily break down into micro-plastics as they can pass through screening elements. Use plastics with a density <0.95 or >1.15g/cm³.

Where possible, design plastic linings or windows that consumers can readily remove – and print a clear message on the packaging that encourages them to do so. Any tear-offs are included in the 5% guidance for the maximum amount of plastic per pack.

Drinks cartons and coffee cups:
Two-sided laminates such as drinks cartons and coffee cups need to be reprocessed separately. Many coffee shops provide collection points, while drinks cartons are often collected at the kerbside or household recycling centres. However, the cartons are often mixed with other recycling and need to be manually separated. A WRAP guidance document on recycling drinks cartons provides more information:

COATINGS AND BARRIERS

WHY CAN THIS BE A PROBLEM?

Depending on their design and the material used, coatings and barriers can be hard to break down during the pulping process.

WHAT ARE THE CONSIDERATIONS?

When specifying coatings or barriers, make sure they allow board or paper to break down into single fibres in suspension when exposed to water, and that plastics and other sealing agents can be easily removed from the fibre. Also ensure that plastics and sealing agents can be dealt with by paper mills and do not compromise the production process, finished paper or environment.

Avoid cured UV varnishes and varnishes that breakdown into small or microplastic particles, and metalised films, as the small particles from these can interfere with machinery and contaminate the final product. Use coatings that are soluble in water, such as starch, which paper mills can treat.
UV INKS AND VARNISHES

WHY CAN THIS BE A PROBLEM?
Any printed material that uses UV inks and varnishes is difficult to recycle and particularly challenging for mills that manufacture graphical papers for news and magazines. The de-inking process struggles to remove the varnishes, so they often pass into the new product, where they can cause flecking and pin holes.

WHAT ARE THE CONSIDERATIONS?
Avoid these types of finishes all together. Choose water-soluble coatings instead, which most paper mills can treat.
TYPES OF FIBRE PACKAGING

WHY CAN THIS BE A PROBLEM?
Most mills in the UK are set up to process paper and board fibre derived from trees. Sometimes they might also process bagasse, palm fibre, rice straw, wheat straw, barley straw, oat straw and other plant fibres.

WHAT ARE THE CONSIDERATIONS?
Think carefully before specifying the sort of paper or board used in packaging, especially if they are alternative fibres that might pose a problem for recycling – generally, they can be recycled if they have been prepared in a way that suits the paper-making process.
TRANSLUCENT AND WATER-RESISTANT PAPER

WHY CAN THIS BE A PROBLEM?
Papers that have ‘wet strength’ or water resistance are not suitable for recycling, as the materials used in them cannot be removed during recycling.

WHAT ARE THE CONSIDERATIONS?
Avoid waxed or wax-coated papers, as the wax will end up in the finished paper.
Avoid silicone and greaseproof papers – these cannot be pulped and will pass into the waste instead. Paper treated in any way cannot be pulped.

Hard-sized products are papers and boards treated with starch to make them resist moisture – for example, the surfaces of some frozen food packaging. Though these products are slow to pulp, most standard paper mills can handle them.
FOOD CONTAMINATION

WHY CAN THIS BE A PROBLEM?
Food remains can create all sorts of problems during the recycling process. Food contamination is also a problem if the paper/card is exported for recycling where there are strict restrictions. Mills can handle paper that has surface stains, but not waste that is still sitting in the pack (free moving) or attached to the surface (residue).

WHAT ARE THE CONSIDERATIONS?
Think carefully about the intended use of paper and board-based packaging with food and whether it is possible to prevent contamination.

- Provide peel-off surfaces to reduce any potential contamination.
- Mark packaging clearly to encourage consumers to clean it before recycling.
- Any packaging that is likely to contain baked-on food, such as oven-ready trays should be marked as non-recyclable.
WHY CAN THIS BE A PROBLEM?
Some adhesives used on tape, labels and binding can soften or plasticise in the heat of the pulper. They agglomerate and stick to the machinery which causes holes and defects in the finished paper. These are known as ‘stickies’.

Hot melt and pressure sensitive adhesives are generally insoluble in water and so don’t disperse during the pulping process. They soften in the pulper to form jelly-like globules that travel through mill filter systems and again stick to the finished paper.

WHAT ARE THE CONSIDERATIONS?
Water soluble adhesives are preferred, assuming that when they dissolve the chemicals formed don’t contaminate the mill waste water treatment system. The data sheet of the proposed adhesive should give this information.

Use cold set, curable or water-soluble adhesives that do not plasticise at temperatures above the typical pulper temperature of 35 degrees Celsius. Avoid hot melt glues that are not fully water soluble.
METALLIC/FOIL BLOCK PRINTING

WHY CAN THIS BE A PROBLEM?
As with films and laminates, metallic and foil block can be difficult to separate from the paper content and the particles can clog up machinery.

WHAT ARE THE CONSIDERATIONS?
Generally, paper mills can recycle packaging that has metallic block printing on no more than 30% of its surface area. Don’t exceed this recommended maximum limit.
WHY CAN THIS BE A PROBLEM?
All paper-based wrapping can be recycled, but problems start when other materials are added. Glitter can end up in the finished paper, causing imperfections that means it cannot be used for printing. Glitter can also melt during the process, building up and ripping the paper.

Heavily laminated paper cannot be recycled, and neither can paper with metallised gold and silver-coloured shapes.

Foiled or plastic-based wrapping cannot be recycled with paper.

WHAT ARE THE CONSIDERATIONS?

The rule of thumb is to keep the pure paper content to a maximum. Try to minimise or even eliminate any additional material on gift wrap. Avoid glitter. If used, mark the paper as not recyclable.
ARE THERE STANDARD TESTS FOR RECYCLABILITY?

A number of protocols, standards and laboratories claim to determine the recyclability of particular materials, but none provide a definitive measure or have cross-industry support. Instead, the Confederation of Paper Industries is working on a suitable test for measuring recyclability.

Specifiers and producers will be able to commission this laboratory test to confirm the recyclability of their packaging. This work should be complete in Spring 2019.
THANK YOU

www.wrap.org.uk/packaging